

Redescription of *Fastosarion superba* (Cox, 1871), with descriptions of two new species of *Fastosarion* from northern Queensland (Pulmonata: Helicarionidae)

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Fastosarion Iredale, 1933 is diagnosed. The reproductive anatomy of each of the following species is described and figured: *Fastosarion superba* (Cox, 1871) (type species of *Fastosarion*) from Mt Dryander and Clarke Range, between Bowen and Mackay, *Fastosarion helenkingae* sp. nov. from Mt Elliot, near Townsville, and *Fastosarion aquavitae* sp. nov. from Brandy Creek, near Proserpine, Queensland.

Keywords: Helicarionidae, *Fastosarion*, redescription, new species

Introduction

Semi-slugs of the family Helicarionidae are common in forests along the eastern coast of Australia. The taxonomy of the group is poorly known. Early descriptions were based largely on shell characters, but the shells of the helicarionid semi-slugs lack many of the characters present in typical helicoid shells and thus gross characters are of little use in species-level taxonomy. Anatomical studies are necessary to elucidate relationships within the Australian Helicarionidae.

Previous investigations on Australian forms include anatomical studies of *Helicarion* Férussac, 1821, from southeastern Australia (Kershaw, 1979, 1981), and *Thularion* Stanistic, 1993, *Eungarion* Stanistic, 1993, *Maladena suturalis* (Odhner, 1917) and *Sitala wilcoxi* (Cox, 1865) from northeastern Australia (Stanistic, 1993a, 1993b; Odhner, 1917).

Specimens of undescribed helicarionids collected at Mt Elliot, near Townsville, and Brandy Creek, near Proserpine, North Queensland, were distinguished from each other and from species of *Helicarion* and other helicarionid semi-slugs on the basis of reproductive anatomy. Examination of specimens of *Fastosarion superba* (Cox, 1871) from Mt Dryander, Mt Macartney, and Eungella, showed these new species, described here, to be congeneric. In order to describe the two new species, it was necessary to first clarify the genus *Fastosarion* Iredale, 1933.

Materials and methods

Material of an undescribed helicarionid was collected during survey work by the

Queensland Department of Environment and Heritage (QDEH) from Mt Elliot (Bowling Green Bay National Park)(19°30'S, 146°58'E). Live specimens were deposited in the Museum of Tropical Queensland, where they were killed by freezing (Scott, 1991), then fixed and preserved in 70% ethanol. Other material was held in the collections of the Queensland Museum, Brisbane.

Type material of *Vitrina superba* was not in the Australian Museum with other types designated by Cox. Smith (1992: 232) recorded the types as "status and whereabouts unknown, presumed lost", and this was confirmed by a search of the collection. However, wet topotypic material from Mt Dryander was examined, as well as specimens from Mt Macartney and Eungella (approximately 100km south of the type locality).

Descriptions of shell and body colour follow Smithe (1975). Descriptions of reproductive tract anatomy follow Quick (1960) and Stanisic (1993a, 1993b).

Systematics

Genus *Fastosarion* Iredale, 1933

Type species: *Vitrina superba* Cox, 1871 by original designation.

Helicarion (*Fastosarion*) Iredale, 1933: 37. Zilch (1959): 309.

Fastosarion Iredale, 1937: 9. Burch, 1976: 134. Smith, 1992: 231.

Diagnosis: Large to very large semi-slug. Dart sac absent. Vagina present. Spermatheca short. Epiphallus with sinuate flagellum at junction with vas deferens. Caecum near insertion of penial retractor muscle. Penis with pilaster, penis lining ornamented with ridges or papillae.

Description:

External appearance: Animal light to dark neutral grey in alcohol. Body long, with tail produced into caudal horn. Lateral edges of mantle extended into left and right pallial lappets which cover shell, and right body lappet superior to pneumostome. Sole tripartite, neutral grey to beige in alcohol.

Shell (Figs. 1, 2): Pale horn to yellow ochre, glossy, fragile. Protoconch iridescent, with sculpture of fine radial ribs; teleoconch with growth lines and very fine radial ribs. Whorls 2.8 – 3.5, body whorl depressed and increasing rapidly. Spire depressed, sutures moderately impressed. Aperture large, roundly ovate. Umbilicus narrow.

Reproductive tract: (Figs 3, 4, 5) Albumen gland rounded, compact. Hermaphroditic duct tightly coiled. Uterus and prostate joined. Free oviduct swollen at junction with vagina. Free oviduct 75% length of vagina. Spermathecal shaft short, spermathecal head swollen, rounded. Vagina swollen, short, less than 20% length of penis/epiphallus complex. Vas deferens coiled proximally, straight distally.

Broad sinuate epiphallic flagellum at junction of vas deferens and epiphallus. Caecum at bend in epiphallus at point of insertion of penial retractor muscle. Epiphallus thin, long, approximately 150% length of penis. Penis thin, long, surrounded by collar-like penis sheath, which is unattached proximally, but inserted on

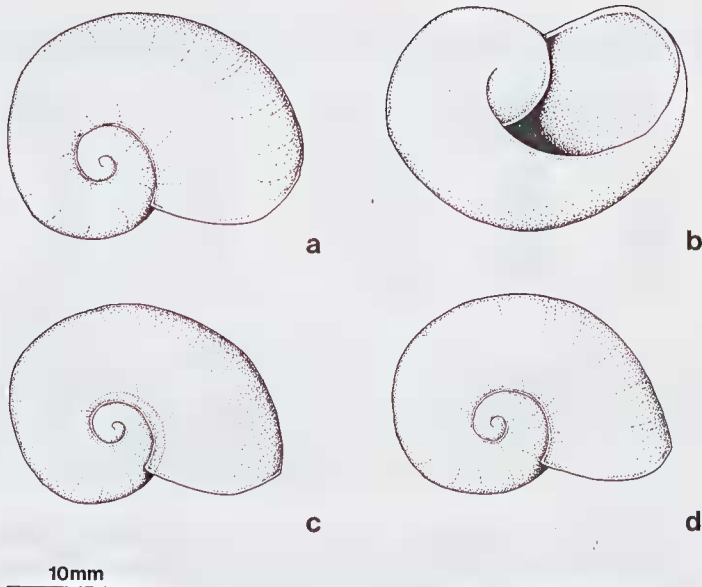


Figure 1. Shells of *Fastosarion*: a, b, shell of *F. superba* (Palm Walk, Eungella); c, shell of *F. helenkingae* sp. nov. (Mt Elliot); d, shell of *F. aquavitae* sp. nov. (Brandy Creek).

genital atrium distally. Penis with pilaster and small verge at junction with epiphallus.

Status of the genus *Helicarion* (type species: *Vitrina superba* Cox, 1871)

Iredale (1933) established *Fastosarion* as a subgenus of *Helicarion* based on size and shell characters, but suggested anatomical studies might result in further separation. He later (Iredale, 1937) raised *Fastosarion* to generic level. The subsequent systematic treatment of *Fastosarion* has been variable. Baker (1941) synonymised *Fastosarion* with *Helicarion*. Zilch (1959) supported Iredale's original decision on placing *Fastosarion* as a subgenus of *Helicarion* (Iredale, 1933). Burch (1976) followed Iredale (1937) and listed *Fastosarion* as a full genus. Smith (1992) synonymised *Vercularion* Iredale, 1933, with *Fastosarion*, and included eight species, most of which were previously placed in *Helicarion*.

The present study showed differences in the reproductive anatomy of *F. superba* and *H. cuvieri*, the type species of *Helicarion*, which are considered robust enough to support *Fastosarion* as a separate genus.

Fastosarion is difficult to distinguish from *Helicarion* and other genera of semi-slugs on external characters other than size. Two features of the reproductive tract separate *Fastosarion* and *Helicarion*: *Fastosarion* has a well-developed vagina and a caecum near the retractor muscle. Both are absent in *Helicarion* (Kershaw, 1979, 1981).

Although Kershaw (1979, 1981) and Dartnall and Kershaw (1978) recorded the presence of a vagina in four species of *Helicarion*, their interpretation of this structure does not follow that of Quick (1960), in which the vagina is the section of the female tract between the genital atrium and the duct of the spermatheca (bursa copulatrix of Dartnall and Kershaw, 1978; Kershaw, 1979, 1981). If the spermathecal duct has its origin at the genital atrium, then the vagina is lacking (Quick, 1960). Illustrations of

Table 1: Comparative reproductive anatomy of selected genera of northeastern Queensland helicarionids (data from this study, Kershaw, Stanisic, 1993a, b; Odhner, 1917)

	<i>Fastosarion</i>	<i>Helicarion</i>	<i>Thularion</i>	<i>Eungarion</i>	<i>Malandena</i>	<i>Sitala</i>
vagina	present	absent	present	present	present	present
spermatheca	short	short	medium	short	?	short
flagellum	sinuate	small	long, straight	sinuate	long, straight	absent
caecum	present	absent	present	present	absent	absent
dart sac	absent	absent	absent	absent	present	present

the four species of *Helicarion* indicate that the duct of the spermatheca opens at the genital atrium (Dartnall and Kershaw, 1978; Kershaw, 1979, 1981), and thus the vagina of *Helicarion* is absent. In *Helicarion* the main element of the distal female genitalia is the free oviduct. There is a distinct vagina in *Fastosarion*, which is longer than the free oviduct.

The differences between *Fastosarion* and *Eungarion* appear less pronounced than those between *Fastosarion* and *Helicarion*. Stanisic (1993b) lists differences in size of animal, shell structure, penial sculpture and number of penial pilasters between the two genera. Characteristics such as the presence of a well-developed vagina and caecum near the penial retractor muscle are shared.

Fastosarion can be distinguished from *Thularion* by the shape of the shell, enlarged mantle lappets, length of the spermatheca, shape of the flagellum, and penial sculpture (Stanisic, 1993a).

Differences between *Fastosarion* and other north-eastern Australian genera are summarised in Table 1.

Fastosarion superba (Cox, 1871)

(Figs 1a, 1b, 2, 3, 4, 5a, 6)

Vitrina superba Cox, 1871: 54. Mt Dryander, Port Denison, Queensland. Cox, 1888 1063, pl. xxi, figs. 8–9.

Helicarion (Fastosarion) superba Iredale, 1933: 37.

Fastosarion superba Iredale, 1937: 9. Smith, 1992: 232.

Material examined: Mt Dryander (20°15'S, 148°33'E): 4 live adults, MVF–NVF *Araucaria* – NVF/palms, in discarded palm fronds, collected by J. Stanisic, D. Potter 6.vii.1983 (QM MO31289). Mt Macartney (20°50'S, 148°33'30"E): 15 live adults and juveniles, slopes of Mt Macartney, Cathu State Forest drive, alt. 900m, NVF/tree ferns in palm fronds, collected by J. Stanisic, D. Potter, N. Potter, 18.v.1990 (QM MO35627). Eungella National Park (21°08'S, 148°32'E): Palm Walk, 16 live adults and juveniles, Palm Walk, inactive in rolled-up palm frond stems, collected by B.J. Scott, J. Seymour, C. Lokkers, 4.x.1988 (MTQ MO40192).

Diagnosis: Very large semi-slug. Penis sheath equal in length to penis. Penial pilasters with parallel V-shaped transverse ridges continuing on rest of lining (Fig. 5a).

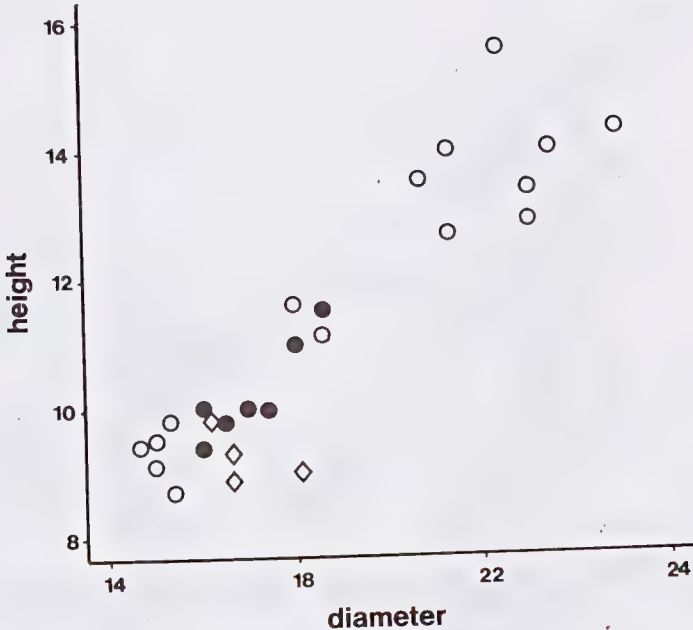


Figure 2. Comparison of shell sizes between *Fastosarion superba* (O), *F. helenkingae* sp. nov. (●), and *F. aquavitae* sp. nov. (◇).

Description:

External appearance: Animal light to dark grey in alcohol, usually with beige suffusion. Left and right pallial lappets darker than right body lappet and mantle. Sole tripartite, beige in alcohol.

Shell: (Fig. 1a, 1b, 2). Colour-pale horn to yellow ochre, glossy, fragile. Height from 8.7 – 15.6 mm (mean 12.7 mm), diameter from 14.7 – 24.9 mm (average 21.0 mm), H/D from 0.56 – 0.7 (mean 0.6). Protoconch iridescent, with sculpture of fine radial ribs; teleoconch with growth lines and very fine radial ribs. Whorls 2.7 – 3.3, body whorl depressed and increasing rapidly. Spire depressed, sutures moderately impressed. Aperture large, roundly ovate. Umbilicus narrow. Data from 14 adults.

Reproductive tract: (Figs 3, 4, 5a). As for genus. Spermathecal shaft short, spermathecal head swollen, rounded. Epiphallus thin, long, approximately 150% length of penis. Penis thin, long, surrounded by collar-like penis sheath, which is unattached proximally, but inserted on genital atrium distally. Penis sheath equal in length to penis. Penis lining with numerous parallel V-shaped ridges and ridged pilaster (Fig. 5a).

Range: Mid-east Queensland: Mt Dryander to Clarke Range (Fig. 6).

Habitat: Mesophyll and notophyll vine forest, with palms.

Discussion: Although the type material of this species has not been located and appears to be either lost or destroyed, no neotype has been designated for this species. Neotypes

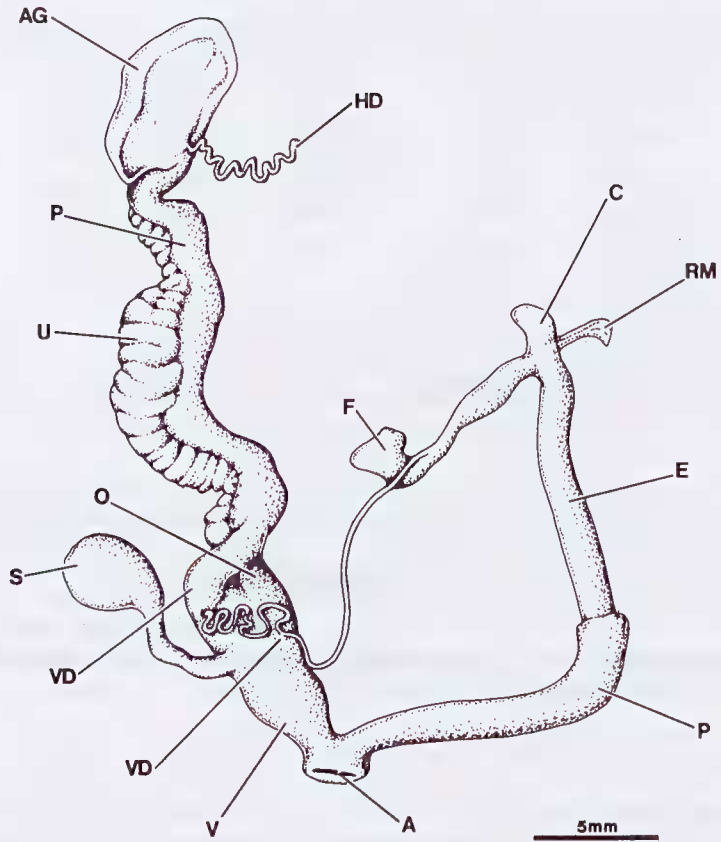


Figure 3. Reproductive tract of *Fastosarion superba* (Palm Walk, Eungella) (A, genital atrium; AG, albumen gland; C, epiphallic caecum; E, epiphallus; F, epiphallic flagellum; HD, hermaphroditic duct; O, free oviduct; P, penis; PR, prostate; PRM, penial retractor muscle; S, spermatheca; U, uterus; V, vagina; VD, vas deferens)

are only to be designated under 'exceptional circumstances' (ICZN, 1985: 157), to define species-group taxa whose identities may be confused or doubtful. *Vitrina superba* Cox, 1871, does not meet the criteria for the selection of new type material.

Cox (1871) described *Vitrina superba* as the largest species of '*Vitrina*'. It is the largest helicarionid in mid-east Queensland, and individuals from Mt Dryander, the type locality, may exceed 8cm in length. Size and coloration varies between populations, but individuals from different populations are indistinguishable on the basis of reproductive anatomy.

Fastosarion superba occurs with *Eungarion mcdonaldi* Stanisc, 1993, at Eungella (Stanisc, 1993b), and probably extends further south along the Clarke Range. It has not been recorded from the Conway Range, despite frequent collecting in the lowland vine forests. *Fastosarion superba* is active at night, but at Mt Dryander and other localities may be found during the day in rolled-up palm leaves.

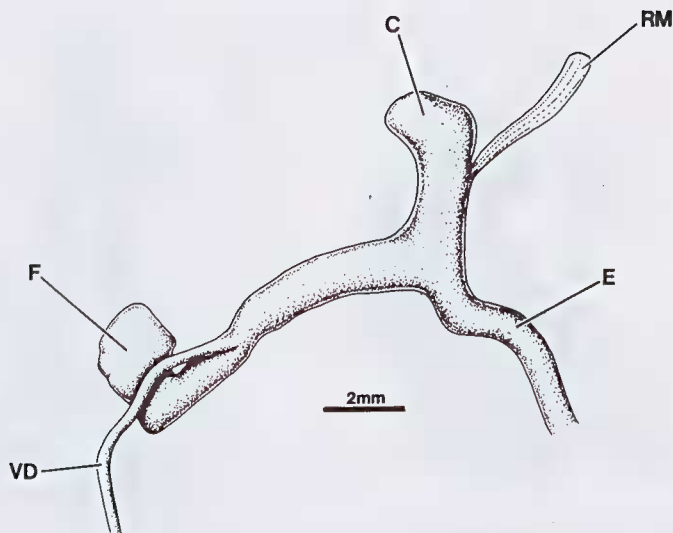


Figure 4. Epiphallic caecum of *Fastosarion superba* (Palm Walk, Eungella) (C, epiphallic caecum; F, epiphallic flagellum; PRM, penial retractor muscle; VD, vas deferens)

Fastosarion helenkingae sp. nov.

(Figs 1c, 2, 5b, 6)

Holotype: Bowling Green Bay NP, Mt Elliot (19°30'S, 146°58'E): rainforest, 900m, 12–18/xii/1990, collected by A. Graham (MTQ MO40184). Shell dimensions: height 11.5 mm, diameter 18.6 mm, H/D 0.62.

Paratypes: Bowling Green Bay NP, Mt Elliott (19°30'S, 146°58'E): 6 live adults, same collection details as holotype (MTQ MO40185–40191).

Etymology: This species is named for Helen King, former Curator of Malacology at the Queensland Museum, Brisbane.

Diagnosis: Medium semi-slug. Shell gold with depressed spire. Pilaster with transverse ridges breaking up into regular high, flattened, pointed papillae on lining (Fig. 5b).

Description:

External appearance: Animal light to dark neutral grey in alcohol. Lappets and mantle same colour as body. Sole tripartite, pale neutral grey with light neutral grey border in alcohol.

Shell: (Figs. 1b, 2). Colour pale horn to yellow ochre, glossy, fragile. Height from 9.4 – 11.5 mm (mean 10.24 mm), diameter from 16.0 – 18.6 mm (average 17.07 mm), H/D from 0.575 – 0.62 (mean 0.6) (Table 2). Protoconch iridescent, with sculpture of fine radial ribs; teleoconch with growth lines and very fine radial ribs. Whorls 3.2 – 3.5, body whorl depressed and increasing rapidly. Spire depressed, sutures moderately impressed. Aperture large, roundly ovate. Umbilicus narrow. Data from 7 adults.

Reproductive tract: (Fig. 5b). As for genus. Spermathecal shaft short, spermathecal

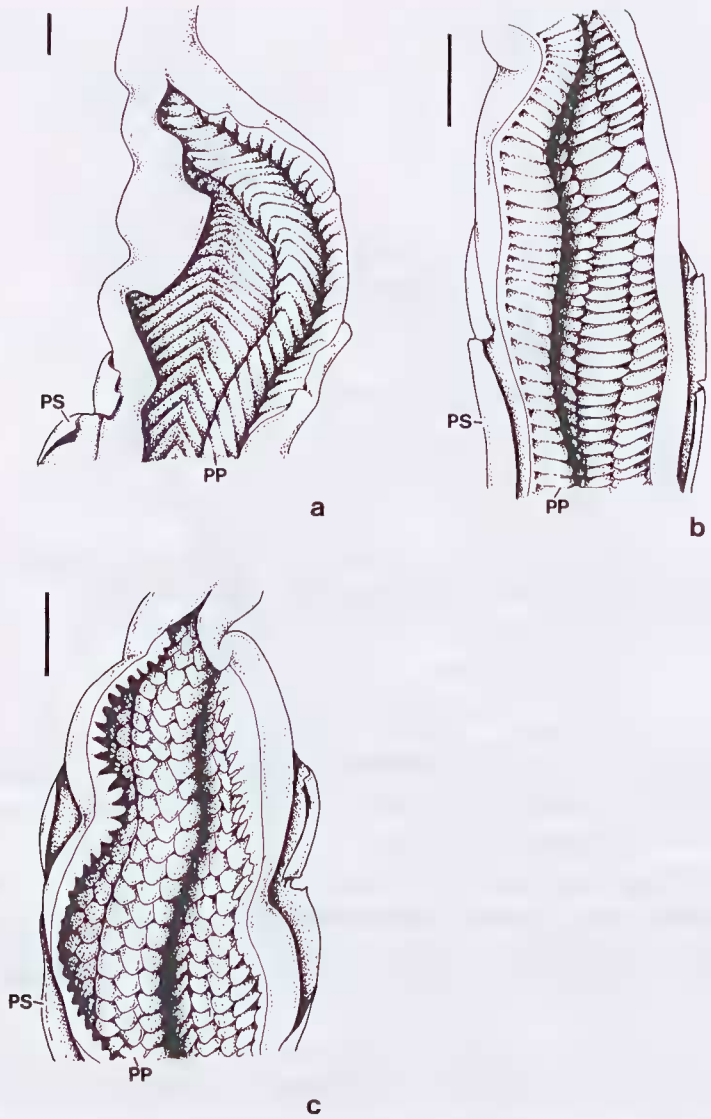


Figure 5. Penial lining: a, *Fastosarion superba* (Mt Dryander); b, *F. helenkingae* sp. nov. (holotype, Mt Elliot); c, *F. aquavitae* sp. nov. (holotype, Brandy Creek) (E, epiphallus; P, penis; PS, penis sheath) (scale bar = 1mm)

head swollen, elongate. Epiphallus thin, long, approximately 150% length of penis. Penis thin, long, surrounded by collar-like penis sheath, which is unattached proximally, but inserted on genital atrium distally. Penis sheath approximately 50% of length of penis. Penis pilaster with transverse ridges breaking up into regular high, flattened, pointed papillae on lining (Fig. 5b)

Range: North-east Queensland: Mt Elliot (Fig. 6)

Habitat: Notophyll vine forest on granite, above 900 m.

Table 2: Shell dimensions of type series of *Fastosarion helenkingae* sp. nov.

	height (mm)	diameter (mm)	H/D
Holotype	11.5	18.6	0.618
Paratypes	11.0	18.0	0.611
	10.0	17.4	0.575
	10.0	17.0	0.588
	10.0	16.1	0.621
	9.8	16.4	0.597
	9.4	16.0	0.587

Discussion: *Fastosarion helenkingae* can be separated from *Fastosarion superba* and *F. aquavitae* by the penial sculpture (Fig. 5b).

This species is known only from a small area of upland vine forest south of Townsville, but subsequent collecting in suitable areas may extend the range. Helicarionids have been reported from gullies on Herveys Range, W of Townsville, but no specimens have been examined.

Fastosarion aquavitae sp. nov.

(Figs. 1d, 2, 5c, 6)

Holotype: Conway Range, Brandy Creek Road (20°20'30"S, 148°39'30"E), edges of Brandy Creek, riverine rainforest, in discarded palm fronds, 15.v.1990, collected by J. Stanisic, D. Potter, N. Potter. Shell dimensions: height 9.9mm, diameter 16.2mm, H/D 0.61 (QM MO55782).

Paratypes: Conway Range, Brandy Creek Road (20°20'30"S, 148°39'30"E), 6 live adults, same collection details as holotype (QM MO35370).

Etymology: The specific epithet (*aquavitae* L. = 'water of life') refers to the type locality, Brandy Creek.

Diagnosis: Medium semi-slug. Shell gold with depressed spire. Penis lined with irregular high, flattened, pointed papillae. Pilaster with staggered papillae (Fig. 5c).

Description:

External appearance: Animal pale neutral grey in alcohol. Lappets and mantle same colour as body, with black patch above pneumostome. Sole tripartite, pale neutral grey with light neutral grey border in alcohol.

Shell: (Figs. 1d, 2). Colour pale horn to yellow ochre, glossy, fragile. Height from 8.9 – 9.9 mm (mean 9.15 mm), diameter from 16.2 – 18.1 mm (average 16.7 mm), H/D from 0.5 – 0.61 (mean 0.55) (Table 2). Protoconch iridescent, with sculpture of fine radial ribs; teleoconch with growth lines and very fine radial ribs. Whorls 2.8 – 3.0, body whorl depressed and increasing rapidly. Spire depressed, sutures moderately impressed. Aperture large, roundly ovate. Umbilicus narrow. Data from 4 adults.

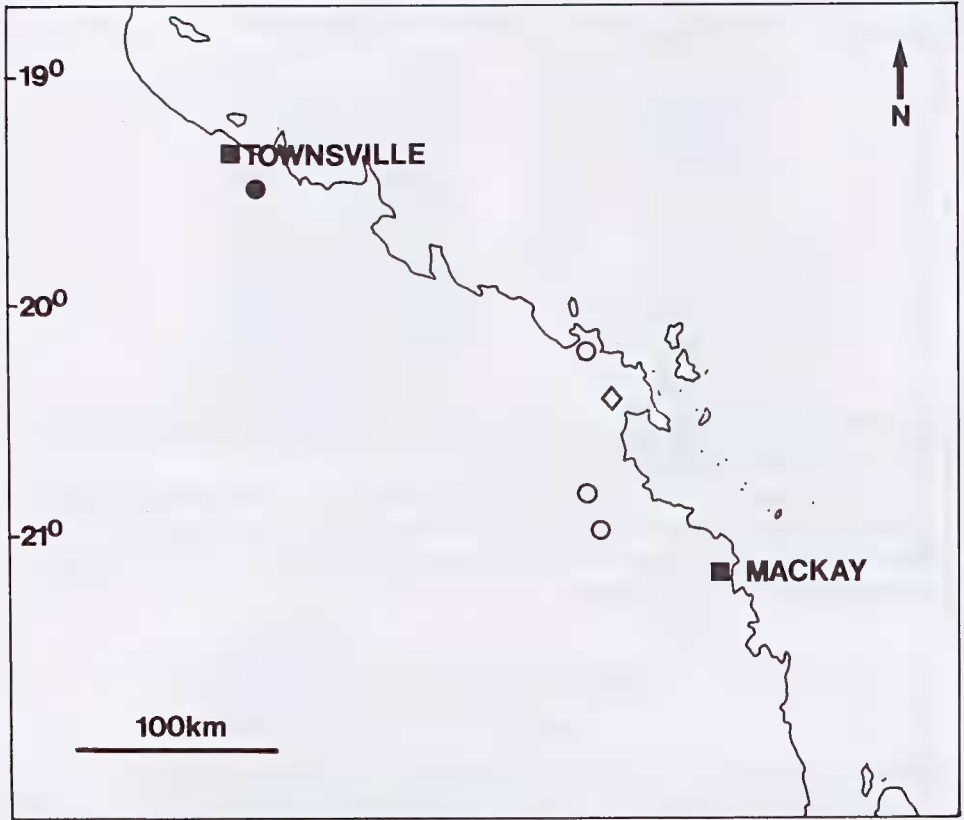


Figure 6. Distribution of *Fastosarion superba* (○), *F. helenkingae* sp. nov. (●), and *F. aquavitae* sp. nov. (◊).

Reproductive tract: (Fig. 5c). As for genus. Spermathecal shaft short, spermathecal head swollen, elongate. Epiphallus thin, long, approximately 140% length of penis. Penis thin, long, surrounded by collar-like penis sheath, which is unattached proximally, but inserted on genital atrium distally. Penis sheath approximately 50% of length of penis.

Penis lined with irregular high, flattened, pointed papillae. Pilaster with staggered papillae (Fig. 5c)

Range: Mid-east Queensland: Brandy Creek, Conway Range (Fig. 6)

Habitat: Riverine rainforest.

Discussion: *Fastosarion aquavitae* can be separated from *Fastosarion superba* and *F. helenkingae* by penial sculpture (Fig. 5c). Like the other two species of *Fastosarion* in mid-east Queensland, its range does not overlap with that of any known congener. It appears to be the only large semi-slug in the Conway Range (J. Stanisic, pers. comm.), but much of the range is poorly known and further collecting may reveal other species.

Table 3: Shell dimensions of type series of *Fastosarion aquavittae* sp. nov.

	height (mm)	diameter (mm)	H/D
Holotype	9.9	16.2	0.611
Paratypes	9.3	16.7	0.556
	9.0	18.1	0.497
	8.9	16.7	0.532

Acknowledgements

Thanks to Alastair Graham (Queensland Department of Environment and Heritage) who collected the specimens used in this study, and to Dr John Staniscic (Queensland Museum) who provided specimens and constructive criticism. Special thanks go to Keith McDonald (QDEH) who provided advice and encouragement at all stages of this and other rainforest snail projects. This is publication no. 6 from the Museum of Tropical Queensland.

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